Facilitating MATHEMATICS Professional Learning:

What does it mean to be a MATH facilitator?

Plenary 2

August 6, 2013

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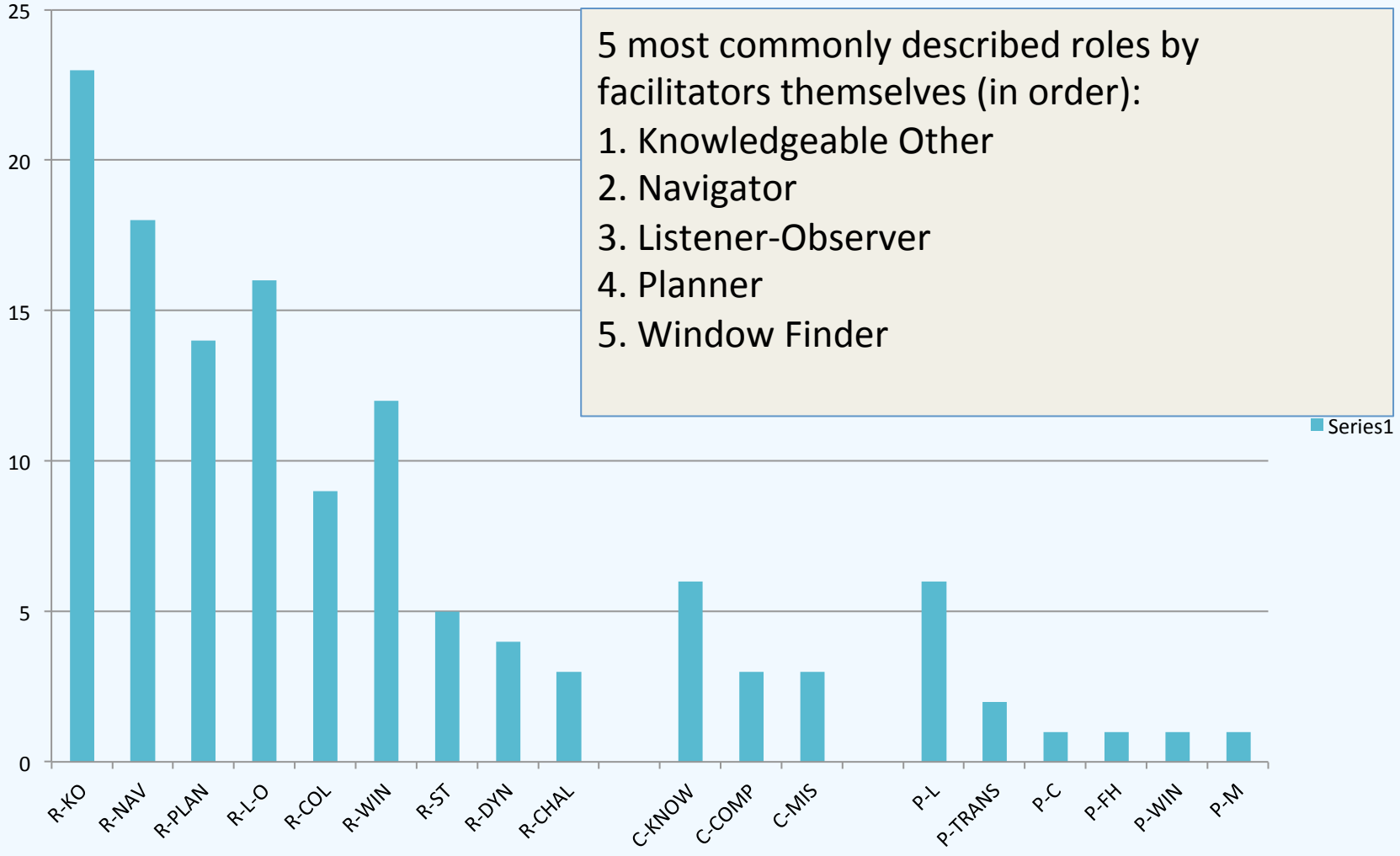
Overview of Themes

Facilitating Professional Learning in Mathematics: How is it different, what are we learning, and what are the challenges?

1. Mathematics Teacher Efficacy
2. Adult Learner Needs
3. Situating Mathematics Inquiry
4. Mathematics PL Facilitation ~ Challenges & Mining the Tensions
5. Evidence of Learning

8:30-10:00

Results from One Set of Data



5 most commonly described roles by facilitators themselves (in order):

1. Knowledgeable Other
2. Navigator
3. Listener-Observer
4. Planner
5. Window Finder

1. Teacher Efficacy in Mathematics

What is Teacher Efficacy in Math?

- Teacher efficacy is a teacher's belief (expectation) that he or she will be able to bring about mathematics student learning.
  - Teachers who believe they will be successful set higher goals for themselves and their students, try harder to achieve those goals, and persist through obstacles
  - Individuals who believe they will fail, avoid expending effort because failure after trying hard threatens self-esteem

Bandura, Tschannen-Moran, Ross, Bruce

Why Teacher Efficacy Matters

1. Those with high teacher efficacy are more likely to try out new teaching ideas, particularly strategies that are difficult, involve risks and require control to be shared with students. (e.g., inquiry-based math learning)
2. High efficacy teachers use classroom management approaches that stimulate student autonomy and reduce custodial control
3. Higher efficacy teachers attend more closely to the needs of *lower ability students in mathematics*
4. Teacher efficacy influences student achievement in math, through teacher persistence, and an expectation that students persist

Student Efficacy: **The student's belief that he or she has the ability to learn math**

Why Student Efficacy Matters

Students who believe they will be successful set higher goals for themselves, try harder to achieve those goals, and persist through obstacles. Students with low efficacy experience a fear of failure.

Student efficacy is a precursor to student achievement

Sources of Efficacy Information

#1. Mastery Experiences

#2. Vicarious Experiences

#3. Social and Verbal Persuasion

#4. Physiological and Emotional Cues

Think about a situation where you have had a mastery experience.
What happened?

Think about:

How do you / can you explicitly support student math efficacy in your role?

How do you / can you explicitly support teacher math efficacy in your role?

2. Adult Learner Needs…

- Agency (empowerment – "my ideas matter")
- Relevance (genuine interest)
- Legitimate decision-making power
- Norms (listening norms and shared expectations for the group)
- Heightened attention to process (obviating and reflecting on the learning process itself)
- To have their prior experiences honoured

Considerations when Facilitating Learning with Adults

- Diagnosis of learning needs (clear content targets)
- Goal alignment for learning and outcomes (do we have a shared understanding of why we are here?)
- The role of experience in the learning (how can it be incorporated?)
- Readiness to learn (there will be a spectrum of deep resistance to overwhelming enthusiasm)
- Climate and existing culture (there may be existing norms which may be productive or non-productive)
- Orientation to learning (what does the adult learner think about how we learn? What level of commitment is present?)
- Attention to structures (naming the structures and reflect on the structures)
- Development and sharing of rich and relevant content
- Accurate assessment of the cultural capital of the facilitator for the group

SURPRISES

Adapted from
Knowles, The adult learner: A neglected species

3. Key Characteristics of High Quality Professional Learning

Teacher Professional Learning

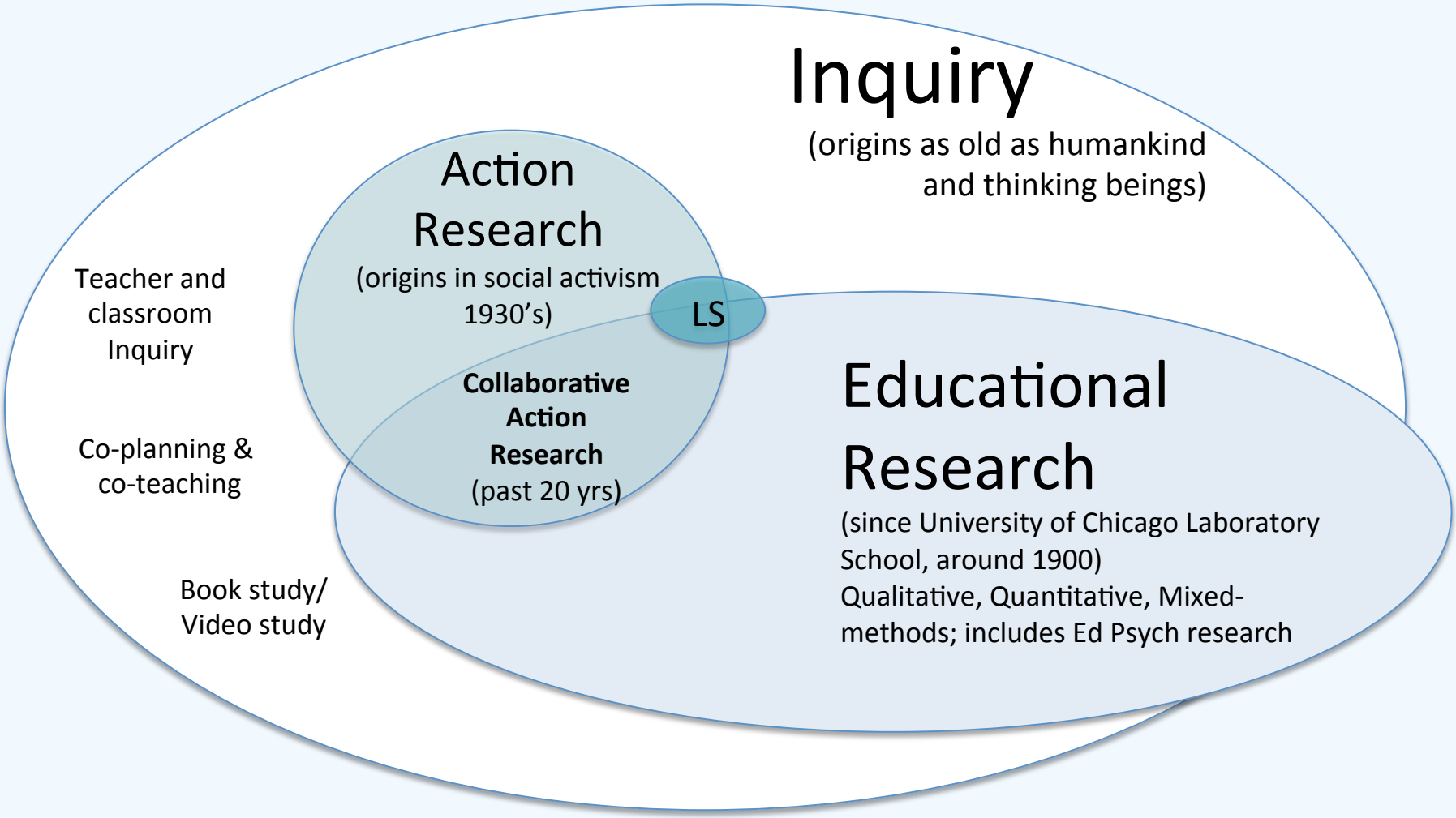
- CLASSROOM-EMBEDDED
- TEACHER-DIRECTED
- RESEARCH-SUPPORTED and CONTENT RICH
- CYCLICAL / ITERATIVE
- SUSTAINED
- COLLABORATIVE

Bruce et. al., 2010
Bruce & Flynn, 2013

TRADITIONAL PD EXPERIENCES	TOWARD A PL MODEL THAT IS INQUIRY-BASED
"Expert" directed projects where educators cooperate with facilitators and researchers	Teacher-directed and research-supported inquiry where educators, facilitators and researchers work collaboratively to engage in areas of mutual interest
Learning environments that are outside the classroom and require translation by educators to the classroom	Classroom-embedded learning where the primary site of inquiry and professional learning is within the classroom context (this also requires an opening of the classroom to 'guests' and collaborators); this model embeds opportunities to practice with support
Punctuated, linear, short workshops or PD sessions with limited or no follow-up or between session implementation	Cyclical, iterative and sustained inquiry over one year or more with implementation occurring formally and informally
"Professional Development": Deficit models of teachers and students (a fix-up model)	"Professional Learning": Asset models of teachers and students (a learning model where all participants bring insights and strengths that help build shared knowledge)
Emphasis on teaching and the teacher	Focus on learning (for all the partners), with an emphasis on students and student learning
External resources and expertise for the PD are required indefinitely, or the long-term supports are not considered after the PD ends	Capacity of the PL team is built explicitly so that the team can sustain their PL more independently over time

Bruce, C. & Flynn, T. (2013). Assessing the Effects of Collaborative Professional Learning: Efficacy Shifts in a Three-Year Mathematics Study. *Alberta Journal of Educational Research, 58* (4), 691-709.
See also Gallimore, Ermeling, Saunders & Goldberg (2009) for additional discussion on "moving the learning of teaching closer to practice".

4. Situating Inquiry & Research Traditions



Thinking More about your Inquiry Work with Teachers

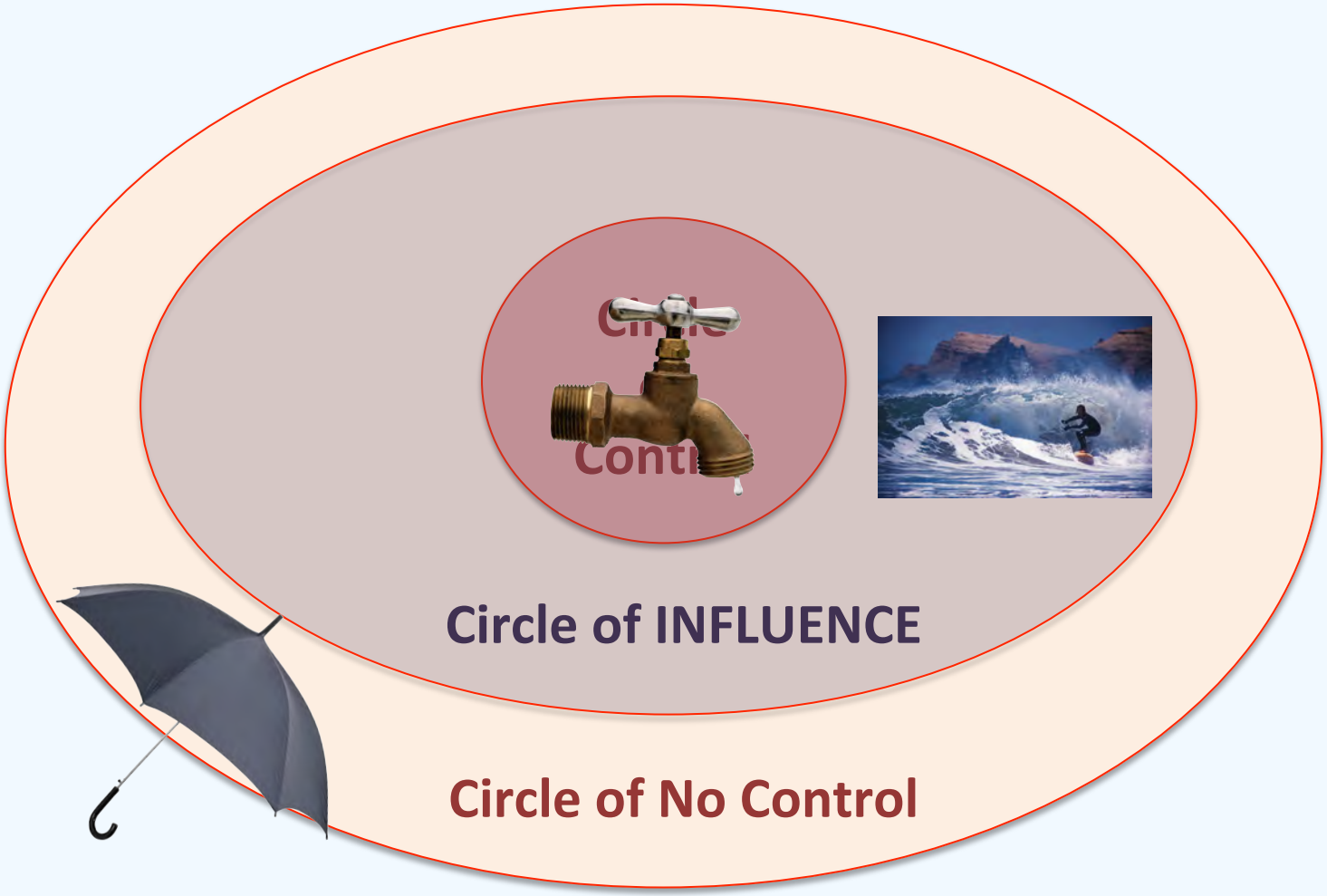
Select one project you worked on last year or one project you will be working on this year. Rate:1,2,3
1 = not so much and 3 = lots

- The topic focuses on an important issue.
- The scope of the topic is narrow enough to make this realistic (time and resources commitment).
- Literature or other resources that will provide background information *can and will* be accessed.

Thinking More about your Inquiry Work with Teachers (rate: 1,2,3)

- The data needed to answer this question will be something we can generate or access or both.
- We are DEEPLY interested in and committed to working on this issue.
- The topic is within my sphere of influence as facilitator; it is do-able in the context of my work.

Circles of Influence



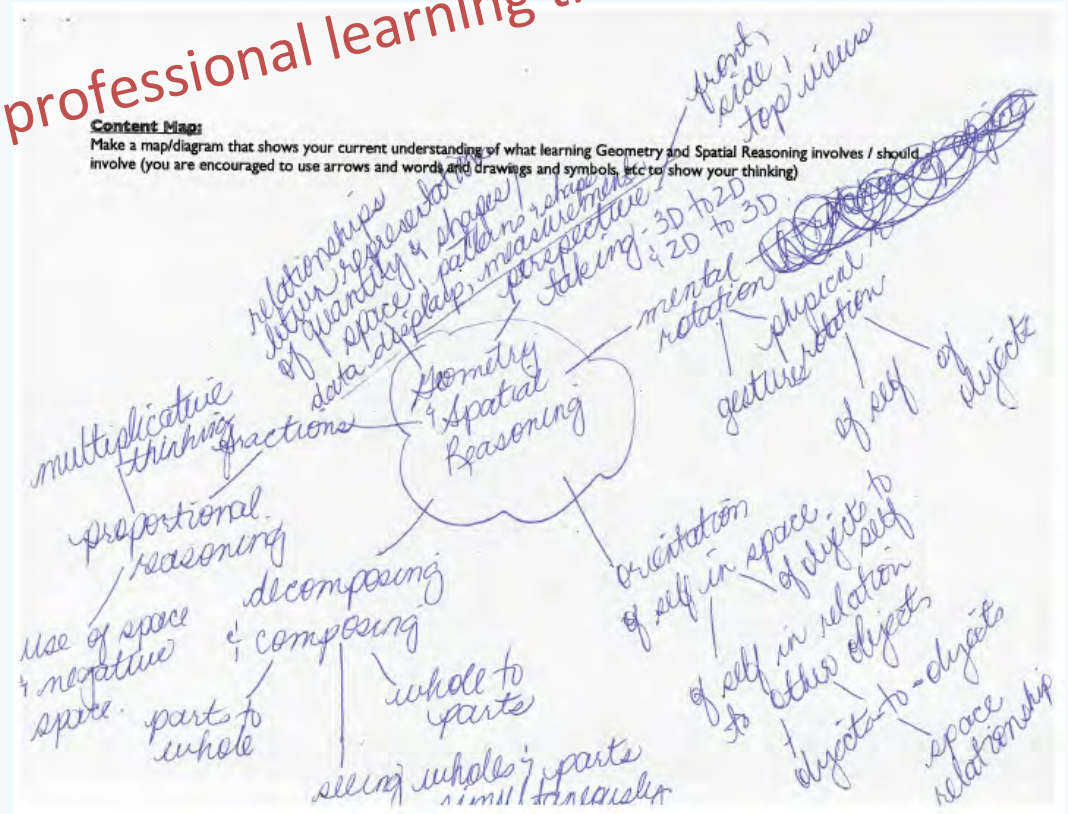
Circle of Influence

4. Facilitating Professional Learning in Mathematics

How is this different than other disciplines?

How is it the same?

What is it about Mathematics professional learning that makes it unique?

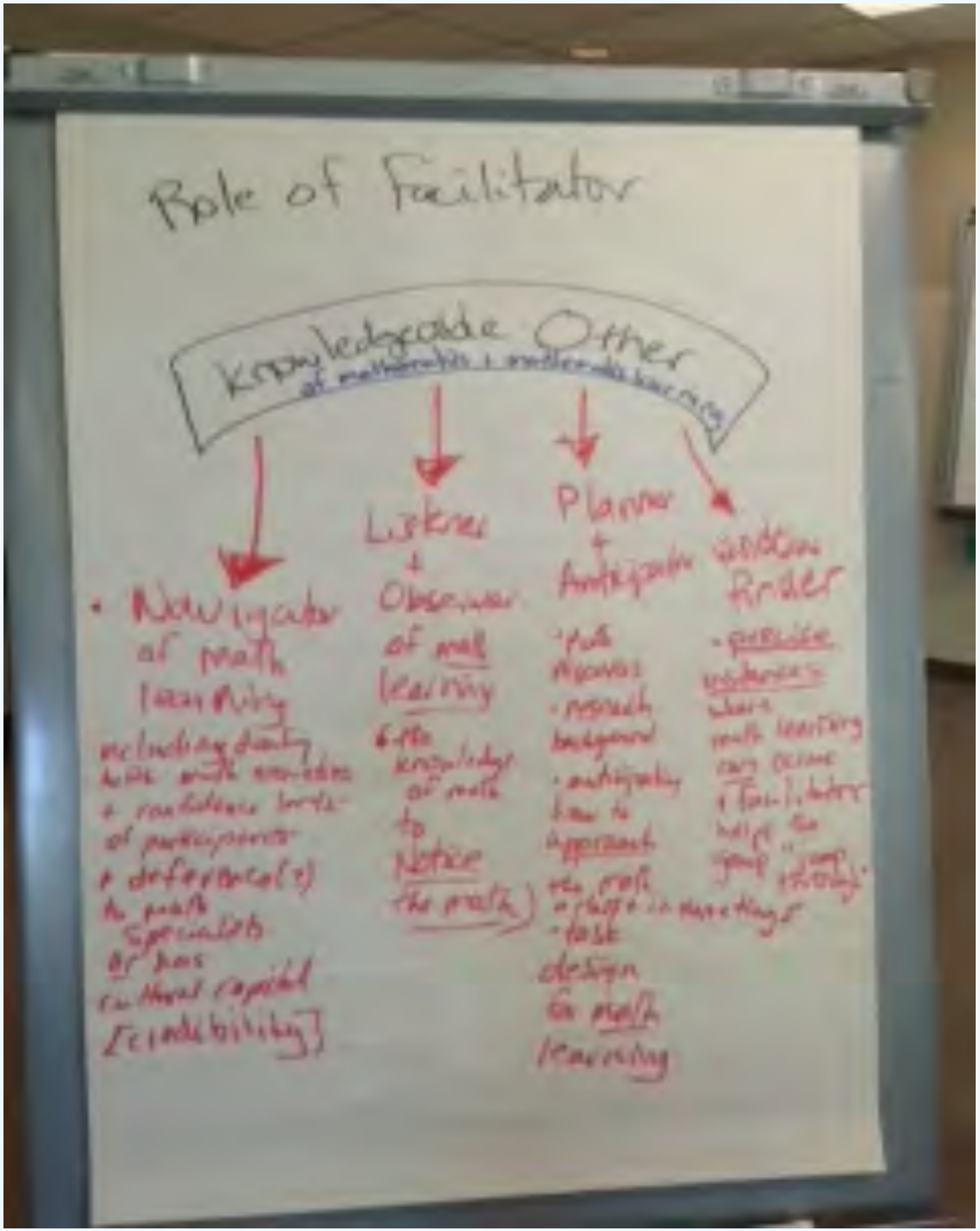


Active Dialogue

- How is Math Facilitation is distinct from general facilitation?

R-List	**Listener; echo back to the group, ears (ongoing)**
R-Plan	**Planner (before)**
R-Obs	**Observer; noticing and feeding back to the group, eyes (ongoing)**
R-Coor	Coordinator; technical details, dates, time keeper (ongoing)
R-Ant	**Anticipator; anticipate pathways of the group, accurate estimations of cultural capital of group members (before)**
R-ST	Set tone for the group as interested learner, as a risk taker, being brave, set group at ease with humour or comments, value, honour and challenge (ongoing)
R-Nav	**Navigator; narrow in and broaden out as needed, refine key questions and points of inquiry, move things forward linking ideas, gives opportunities for reflection, leaves responsibility for learning with the participants and synthesizes ideas (ongoing)**
R-KO	**Knowledgeable Other; prepare and bring content, materials and information to the group (ongoing)**
R-Win	**Window finder; find window to jump through to help the group leap forward (ongoing)**
R-Coll	Collaborator (ongoing)
R-Dyn	Dynamics; intervening when necessary, group dynamics and management (ongoing)
R-Chall	Challenger; encourage positive dissonance, **challenge preconceived notions, uncover misunderstandings,** engage in discourse (ongoing)

Role of Math Facilitator



Role of Math Facilitator

Navigator of Math Learning	Listener and Observer	Planner and Anticipator	Window Finder
Getting the PL math activities at the right level of challenge and interest	The knowledge of math to notice the math (and to help others notice the math)	Math resources and research background	Finding the precise instances of potential math learning for the team (and for students); and help the group through the window
Building efficacy to teach and learn math (for participants)		Anticipating how to approach the math	
Cultural capital		Task design for math learning	

Mathematics Professional Learning Challenges

- Content challenges
  - Teachers with limited background in math
- Pedagogical challenges
  - Teachers with ample content background (were successful at math) but limited interest in understanding struggling math students
- Cultural challenges (struggling under misconceptions of an either-or culture)
  - Teacher-directed versus student directed
  - Emphasis on basic skills versus emphasis on problem solving
  - Concepts versus procedures
  - Math is really about numbers and symbols
  - Math Anxieties

Content Challenge: Teacher Knowledge

- Teacher knowledge is significantly correlated with student achievement (Hill, Rowan & Ball, 2005)
- Teachers of young children have less formal math training, have less math support and experience than any other teaching population (Perry & Dockett, 2008)

Math as Predictor of School Success

- Duncan et al. (2007, 2009, 2011) identified early math skills as best predictor of school success in math, language and social studies

And yet studies show:

- Less time each day devoted to math learning: 7-17% of day (versus 18-30% on literacy or 13-24% on social studies) (Phillips, Gromley & Lowenstein, 2009)

We avoid what we don't know well

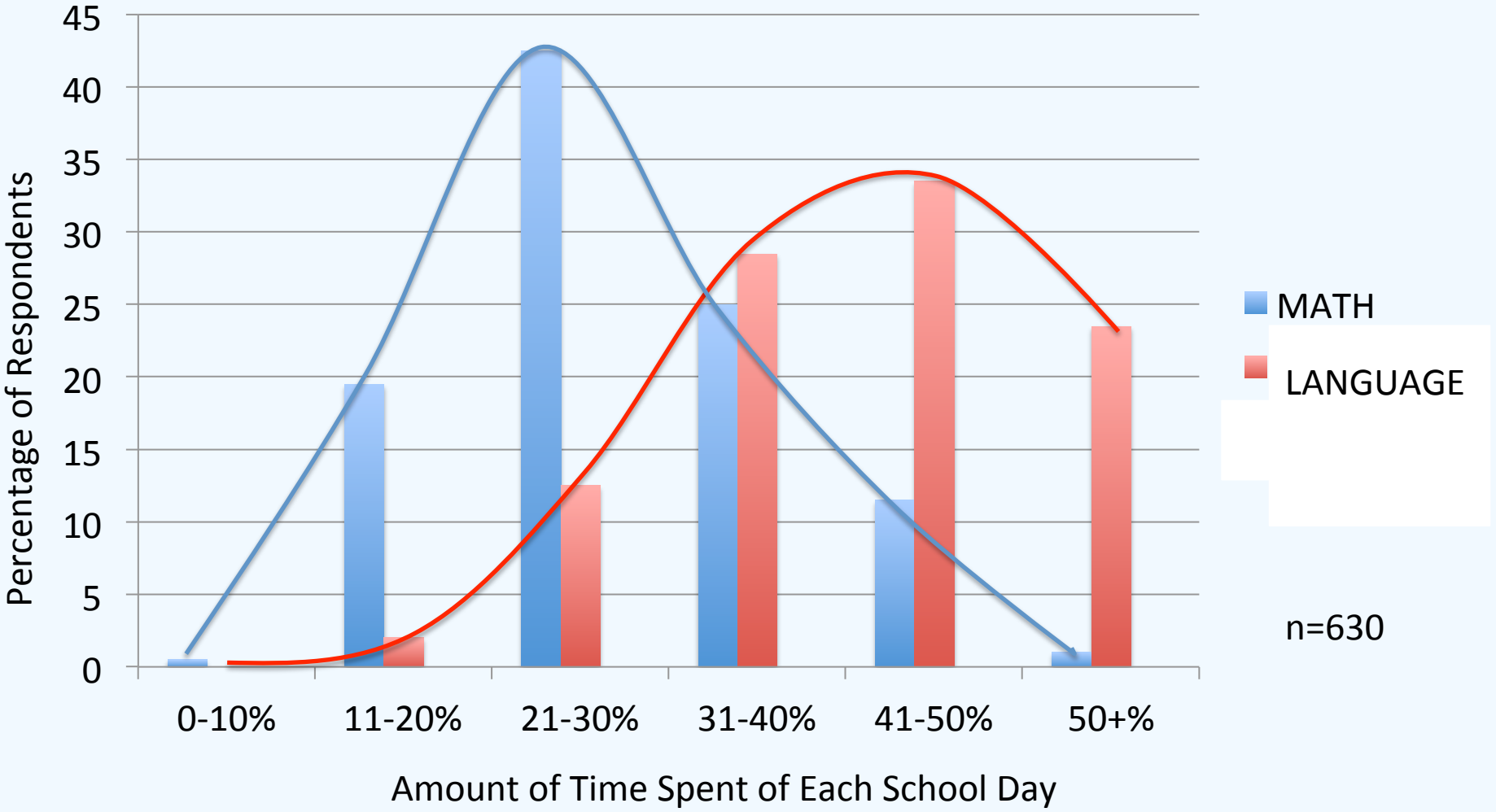
Ontario Data, 2012

Percentage of Classroom Time	MATH		LANGUAGE	
	JK-SK	Gr 1-2	JK-SK	Gr 1-2
0-10%	1	0	0	0
11-20%	23	16	3	1
21-30%	38	47	11	14
31-40%	24	26	25	32
41-50%	12	11	33	34
more than 50%	1	1	27	20

37.5% of respondents reported spending more than 30% of their time on mathematics tasks whereas 85.5% of respondents reported spending more than 30% of their time on literacy tasks (n=630)

Bruce, Ross & Moss, 2012

Means for Language & Math: Time on Task in Ontario Sample



Bruce, Ross & Moss, 2012

Time Spent on Each Math Strand

Math Area	JK/SK Mean (N=249)	RANK	Gr1-2 Mean (N=293-298)	RANK	Significance	Effect Size Cohen's d
Patterning	3.99 (0.90)	2	3.54 (0.89)	2	t(540) =2.38, p < .001	0.51
Number Sense	4.73 (0.62)	1	4.53 (0.74)	1	t(544) =3.50, p < .001*	0.29
Geometry	3.56 (0.79)	4	3.15 (0.79)	5	t(540) =2.53, p < .001	0.52
Data Management	3.64 (0.95)	3	3.37 (1.00)	3	t(541) = 3.26, p < .001	0.28
Measurement	3.38 (0.84)	5	3.34 (0.91)	4	t(540) = 2.21, p =.627	0.05

never; less than monthly; 2-3 three times each month; weekly; daily
n=630

Bruce, Ross, Moss, 2012

Pedagogical Challenges

Cultural/Psychological Challenges
Math Phobias & Dis-functional Beliefs

- “I hate math, it’s too hard”
- “I was never good at math”
- “I don’t have the math gene” / “You don’t have the math gene”
- “If I don’t get the answer right away, I stop trying”
- “Math isn’t really for all of us”

Big Challenge: Facilitating math when you don't know it all

Complexities of facilitating math - no simple or quick solutions but….

(i) in-between session learning

(ii) sustained team inquiry

(iii) moves beyond surface learning with content focus

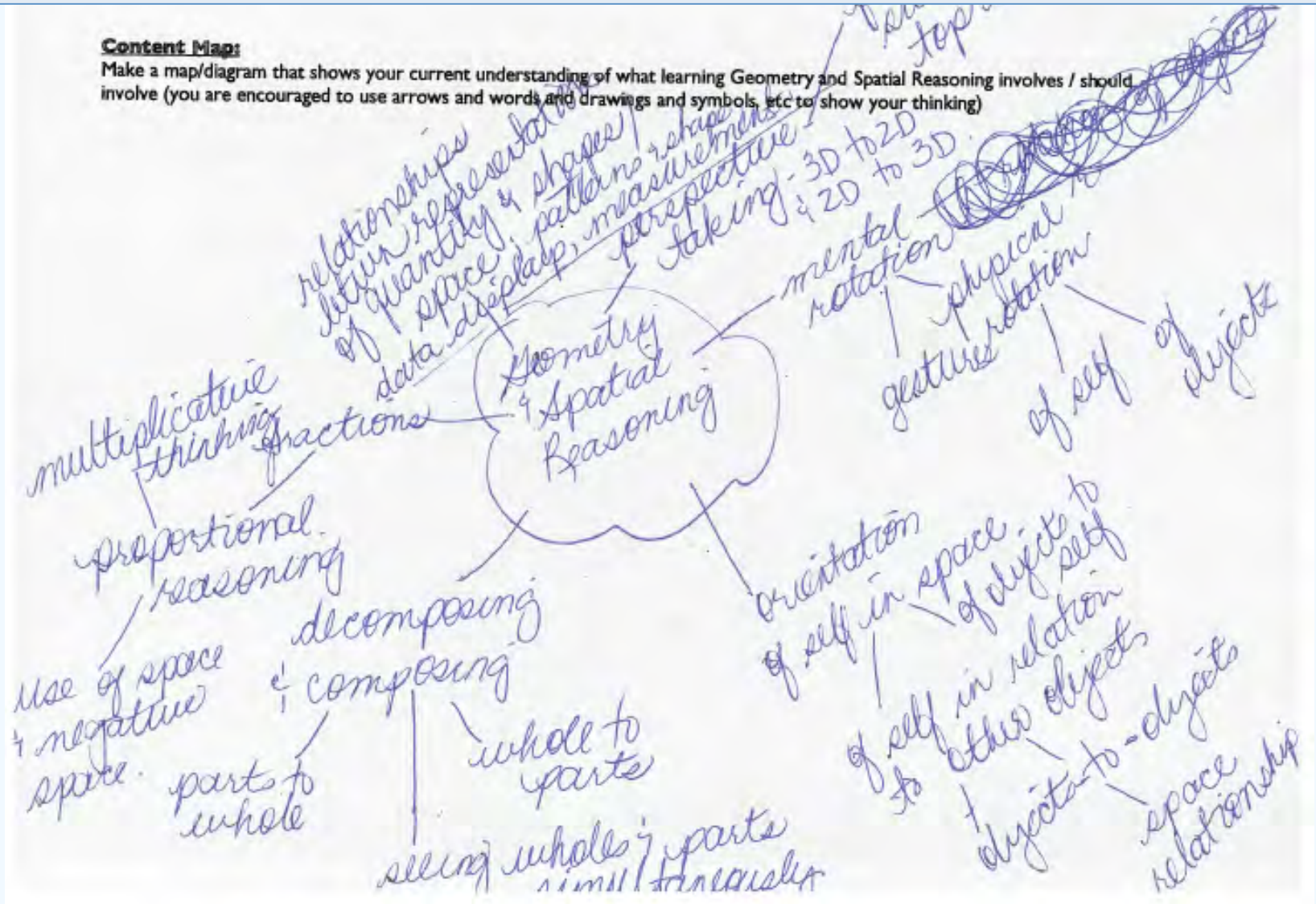
- Networking in this room (find some buddies – help one another with content)
- Networking in your own district (find more buddies!) that can help you
- Honouring people who are not particularly strong in math; for that person inquiry involves risk-taking and learning stance

None of us know it all….

Revealing and Mining the Tensions

- Challenge you to do this:
  - Next year, keep a log of tensions you are noticing
  - Share these with a colleague or if appropriate your professional learning team
  - Write about it
  - Learn from it

5. Evidence of Learning



Teacher Learning Through CAR:

a) Understanding of early algebra

Shift From	Shift To
Surface level content knowledge of repeating and growing patterns (leading to rote delivery of instruction)	• Deep understanding of repeating and growing patterns as a foundation to mathematics (leading to inquiry-based teaching and learning) • Multiple approaches/strategies to teaching patterning (Careful task selection; anticipation of student responses to tasks; emphasis on student creation and analysis of patterns; thoughtful approach to consolidation)

Teacher Self-Reports

I can't tell you how much this project has affected my teaching style and my understanding of patterning and algebra. It has made math less scary to me! I have changed my way of looking at teaching math from me being a presenter at the front to beginning to teach as a math community where everyone shares the teaching….I am teaching the child as a math learner instead of covering individual curriculum expectations. I am concentrating on the higher order thinking skills and math processes and building a math community.

~Teacher participant

Teacher Learning Testimonials

Confidence through content learning and teacher research

- “The research behind our thinking is very clear and we’re not making it up as we go.”
- “I really learned a lot about the power of decomposing and recomposing numbers. And we can see how they subitize and then we can give them tools (like 5 frames and 10 frames) to make and break apart. Or ‘I want to use 3 numbers! How do I decompose 20?’ And what does this do for their understanding of number. These pieces were really good for me in terms of content learning.”